

UNCLASSIFIED

AD NUMBER	
AD397826	
CLASSIFICATION CHANGES	
TO:	unclassified
FROM:	confidential
LIMITATION CHANGES	
TO:	Approved for public release, distribution unlimited
FROM:	Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 07 JAN 1953. Other requests shall be referred to Naval Proving Ground, Dahlgren, VA.
AUTHORITY	
Jun 1957, per doc markings; NPG per DTIC form 55	

THIS PAGE IS UNCLASSIFIED

THIS REPORT HAS BEEN DELIMITED
AND CLEARED FOR PUBLIC RELEASE
UNDER DOD DIRECTIVE 5200.20 AND
NO RESTRICTIONS ARE IMPOSED UPON
ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

UNCLASSIFIED

AD 397526

CLASSIFICATION CHANGED
TO: UNCLASSIFIED_
FROM: CONFIDENTIAL
AUTHORITY:

_____ *USM-SUC*
_____ *1-1-77*

UNCLASSIFIED

SECURITY

MARKING

The classified or limited status of this report applies to each page, unless otherwise marked.

Separate page printouts MUST be marked accordingly.

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

UNANNOUNCED

CONFIDENTIAL
SECURITY INFORMATION

AD 397826

U. S. NAVAL PROVING GROUND

DAHLGREN, VIRGINIA

REPORT NO. 1070

JUN 7 1957

TEST AND DEVELOPMENT OF 3"/70 A.A. PROJECTILES

50th Partial Report

TEST AND DEVELOPMENT OF 3"/70 CALIBER GUN BARRELS

55th Partial Report

COMPARATIVE RANGING TEST OF 3"/70 A.A. PROJECTILES

TYPES EX 24 MOD 7, EX 24 MOD 9, EX 24 MOD 12 AND
MK 34 MOD 1, IN GUNS TYPE G MOD 7 AND 11

FINAL Report

Copy No. 14

Task NPG-Re3b-210-1-52

Assignment NPG-Re5a-21-1-52

Classification CONFIDENTIAL
SECURITY INFORMATION

LIBRARY OF CONGRESS
REFERENCE DEPARTMENT
TECHNICAL INFORMATION DIVISION
FORMERLY
(NAVY RESEARCH SECTION)

FEB 16 1953

This document contains information affecting the National
Defense of the United States within the meaning of the
Espionage Laws, Title 18, U. S. C., Section 793 and 794.
Its transmission or the revelation of its contents in
any manner to an unauthorized person is prohibited by law.

DOWNGRADED AT 12 YEAR
INTERVALS: NOT AUTOMATICALLY
DECLASSIFIED. DOD DIR 5200.40

CONFIDENTIAL
SECURITY INFORMATION

NPG REPORT NO. 1070

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

PART A

SYNOPSIS

1. This is a report of tests conducted for the purpose of investigating the comparative ranging performance of 3"/70 A.A. Projectiles Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and Mk 34 Mod 1, in Guns Type G Mod 7 Serial No. 26741 and Type G Mod 11 Serial No. 24930, and to substantiate the previous firings in the Type G Mod 7 Barrel Serial No. 24579.

2. The results of the tests indicate that:

a. When fired from the 3"/70 Caliber Type G Mod 7 Gun:

(1) The EX 24-9 projectiles gave better range performance than either the EX 24-12 or Mk 34-1 projectiles.

(2) The Mk 34-1 projectiles gave decidedly better range performance than the EX 24-12 projectiles.

b. When fired from the 3"/70 Caliber Type G Mod 11 Gun:

(1) The EX 24-9 projectiles gave better range performance than either the EX 24-7, EX 24-12 or Mk 34-1 projectiles.

(2) The Mk 34-1 projectiles gave decidedly better range performance than either the EX 24-7 or EX 24-12 projectiles.

(3) The British complete rounds assembled with Primer Groups No. 1 and No. 2 and with projectiles of similar design to the EX 24-9 projectiles gave range performance comparable to the EX 24-9 projectiles.

c. The EX 24-7 projectiles gave much better range performance in the worn Type G-7 Gun No. 24579 than in the new Type G-11 Gun No. 24930.

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

TABLE OF CONTENTS

	<u>Page</u>
SYNOPSIS	1
TABLE OF CONTENTS	2
AUTHORITY	3
REFERENCES	3
BACKGROUND	3
OBJECT OF TEST	4
PERIOD OF TEST	4
DESCRIPTION OF ITEMS UNDER TEST	5
DESCRIPTION OF TEST EQUIPMENT	6
PROCEDURE	7
RESULTS	10
CONCLUSIONS	11
APPENDIX A - SUMMARIES OF RESULTS OF COMPARATIVE RANGING TESTS OF 3"/70 A.A. PROJECTILES TYPES EX 24-7, EX 24-9, EX 24-12, AND MK 34-1 IN GUNS TYPE G MOD 7 AND 11	TABLES I-V (Incl)
APPENDIX B - PHOTOGRAPH OF BUORD SKETCH NO. 328486 OF 3"/70 PROJECTILE (A.A.) TYPE EX 24 MOD 9	FIGURE 1
PHOTOGRAPH OF BUORD SKETCH NO. 249878 OF 3"/70 PROJECTILE (A.A.) TYPE EX 24 MOD 7	FIGURE 2
COPY OF BUORD DWG. 982549, NO REVISION, SHOWING REAR BAND OF 3"/70 (A.A.) PRO- JECTILE MK 34 MOD 1	FIGURE 3
PHOTOGRAPH OF BUORD SKETCH NO. 329480 OF 3"/70 PROJECTILE (A.A.) TYPE EX 24 MOD 12	FIGURE 4
APPENDIX C - DISTRIBUTION	1 (Only)

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

PART B

INTRODUCTION

1. AUTHORITY:

The tests described in this report were authorized by reference (a), modified by references (b), (c), (d) and (e), and by the authority of reference (f).

2. REFERENCES:

- a. BUORD Conf ltr Re5a-FBW:cmj NP9 Ser 32545 of 15 Jan 1952
- b. BUORD Conf ltr Re5a-FBW:cmj S74-1(3") Ser 33544 of 5 Feb 1952
- c. BUORD Conf ltr Re5a-FBW:cmj NP9 Ser 36937 of 28 Mar 1952
- d. BUORD Conf ltr Re5a-JW:vl S74-1(3") Ser 41265 of 19 Jun 1952
- e. BUORD Conf ltr Re5a-FBW:sf S74-1(3") Ser 41255 of 25 Jun 1952
- f. BUORD Conf ltr Re3b-MAS/MRH:mt S78-1(56-3") Ser 41202 of 24 Jun 1952
- g. NPG Report No. 942 of 7 May 1952
- h. NPG Report No. 1011 of 18 Aug 1952
- i. NAVPROV 3"/70 Ranging Data Sheet No. 137 of 12 Mar 1952
- j. NAVPROV 3"/70 Ranging Data Sheet No. 138 of 7 Apr 1952
- k. NAVPROV 3"/70 Ranging Data Sheet No. 139 of 3 Jun 1952
- l. NAVPROV 3"/70 Ranging Data Sheet No. 142 of 16 Jul 1952
- m. NAVPROV 3"/70 Ranging Data Sheet No. 143 of 5 Aug 1952

3. BACKGROUND:

a. Reference (g) reported in detail the initial programs of comparative ranging of 3"/70 A.A. Projectiles Types EX 24 Mods 7, 8, and 9 in new and worn guns Type G Mod 7. Reference (h) reported in detail additional comparative ranging tests which were intended to determine what design features were responsible for the superior range performance of the Projectile Type EX 24 Mod 9 compared to the Type EX 24 Mods 7 and 8 projectiles in new and worn Type G Mod 7 3"/70 caliber guns.

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

b. Reference (a) modified by references (b), (c), (d) and (e) authorized comparative ranging tests using EX 24 Mod 7 projectiles to substantiate the previous firings in the Type G Mod 7 Barrel Serial No. 24579 and to conduct a ranging comparison test of 3"/70 A.A. Projectiles Type EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and Mk 34 Mod 1, in Guns Type G Mod 7 Serial No. 26741 and Type G Mod 11, Serial No. 24930.

4. OBJECT OF TEST:

a. The object of the comparative ranging programs described in this report was to establish a ranging comparison of 3"/70 A.A. Projectiles Type EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and Mk 34 Mod 1, in guns Type G Mod 7 Serial No. 26741 and Type G Mod 11 Serial No. 24930, and to substantiate the previous firings in the Type G Mod 7 Barrel Serial No. 24579.

5. PERIOD OF TEST:

a. Date Project Letter	15 Jan 1952
Dates Project Modification	5 Feb 1952
	28 Mar 1952
	19 Jun 1952
	25 Jun 1952
b. Date Commenced Test	12 Mar 1952
c. Test Completed	5 Aug 1952

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

PART C

DETAILS OF TEST

6. DESCRIPTION OF ITEMS UNDER TEST:

a. Projectiles:

<u>Type</u>	<u>Rear Band Metal</u>	<u>Rear Band Design</u>	<u>Front Band Metal</u>	<u>Front Band Design</u>	<u>Remarks</u>
EX 24-7	Gilding Metal	Figure 2 Appendix (B)	Gilding Metal	Figure 2 Appendix (B)	EX 24-7 Stand- ard Projectile.
EX 24-9	Copper	Figure 1 Appendix (B)	Steel	Figure 1 Appendix (B)	EX 24-9 Stand- ard Projectile.
EX 24-12	Gilding Metal	Figure 4 Appendix (B)	Gilding Metal	Figure 2 Appendix (B)	EX 24-7 Stand- ard Projectile with four (4) cannelures machined into the rear band and straight- ening of the slope on the large rear-band rib.
Mk 34 Mod 1	Gilding Metal	Figure 3 Appendix (B)	Gilding Metal	Figure 2 Appendix (B)	EX 24-7 Stand- ard Projectile with four (4) cannelures machined into the rear band.

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

7. DESCRIPTION OF TEST EQUIPMENT:

- a. Guns: 3"/70 Cal. Type G Mod 11 Serial No. 24930
Rifling - 1 turn in 20 calibers, Uniform Twist
Rounds before test: 37 actual rounds
37.65 ESR Δ Do 0!002
Rounds after test: 281 actual rounds
281.65 ESR Δ Do 0!003
- 3"/70 Cal. Type G Mod 7 Serial No. 26741
Rifling - 1 turn in 20 calibers, Uniform Twist
Rounds before test: 33 actual rounds
32.77 ESR Δ Do 0!003
Rounds after test: 108 actual rounds
107.77 ESR Δ Do 0!0055
- b. Charges: Cases: Steel, Experimental No. 5 for U.S. Rounds;
British Cases Lot 5 for British Primer
Group Nos. 1 and 2 (Table II, Appendix (A)).
- Primers: XC-M11 for U.S. Rounds; XC-M11 Modified
for British Primer Group No. 1 and Primer
No. 13 for British Primer Group No. 2
(Table II, Appendix (A)).
- Powder: 10.11 lbs. Powder Index HKPC-1 for Gun
Serial No. 24930, 9.95 lbs. Powder Index
HKPC-1 for Gun Serial No. 26741 on U.S.
Rounds, 10.00 lbs. 2 oz. 15 grams, Index
RNP-293 for British Rounds in Primer
Group Nos. 1 and 2 (Table II, Appendix (A)).
- c. Velocity Measuring
Devices: Standard oscillograph and chronograph
equipment.
- d. Pressure Gages: 1/30 sq. in. area copper crusher type.

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

8. PROCEDURE:

a. The following programs were fired in accordance with reference (a) modified by reference (b):

Date: 12 March 1952 - Elevation: 15 degrees

Gun: Type G Mod 11 No. 24930

No. Rds.	Loading and Fuzing	Type Projectiles - fired in alternating five (5) round groups (Table I, Appendix (A))
20	Salts and DNP 238911	Standard EX 24-7 (Figure 2, Appendix (B)).
20	Salts and DNP 238911	Mk 34-1 Projectile like EX 24-7 with four (4) cannelures machined into the rear band (Figure 3, Appendix (B)). BUORD Dwg. 982549, No Revision, Mk 34 Mod 1.
20	Salts and DNP 238911	Standard EX 24-9 (Figure 1, Appendix (B)).

Date: 7 April 1952 - Elevation: 15 degrees

Gun: Type G Mod 11 No. 24930

No. Rds.	Loading and Fuzing	Type Projectiles - fired in five (5) round groups (Table II, Appendix (A))
40	Salts and DNP 238911	Mk 34-1 Projectile like EX 24-7 with four (4) cannelures machined into the rear band (Figure 3, Appendix (B)). BUORD Dwg. 982549, No Revision, Mk 34 Mod 1.
5		British assembled Primer Group No. 1.
5		British assembled Primer Group No. 2.

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

b. Reference (c) modified the comparative ranging tests authorized by reference (a) modified by reference (b) to substitute EX 24 Mod 12 projectiles, Bureau of Ordnance Sketch 329480, (Figure 4, Appendix (B)) for the unmodified EX 24-7 projectiles (Figure 2, Appendix (B)) throughout the remainder of the comparative ranging tests. The following program was fired in accordance with reference (c):

Date:	3 June 1952 - Elevation: 15 degrees
Gun:	Type G Mod 11 No. 24930
No. Loading Rds. and Fuzing	Type Projectiles - fired in five (5) round groups (Table III, Appendix (A))
40 Salts and DNP 238911	EX 24-12 Projectile like EX 24-7 with four (4) cannelures machined into the rear band and straightening of the slope on the large rear band rib, BUORD Sketch 329480 (Figure 4, Appendix (B)).
5 Salts and DNP 239269	

c. References (e) and (f) further modified the comparative ranging tests authorized by reference (a) modified by references (b), (c) and (d) in order that the relatively larger dispersions obtained on 3 June 1952 (Table III, Appendix (A)) using Projectiles Type Ex 24-12 Bureau of Ordnance Sketch 329480 (Figure 4, Appendix (B)), compared to the lower dispersions obtained on 7 April 1952 (Table II, Appendix (A)), using Projectile Mk 34-1 Bureau of Ordnance Dwg. 982549, No Revision, (Mk 34 Mod 1) (Figure 3, Appendix (B)) might be clarified. The following programs were fired in accordance with references (e) and (f):

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

Date: 16 July 1952 - Elevation: 15 degrees

Gun: Type G Mod 11 No. 24930

No. Rds.	Loading and Fuzing	Type Projectiles - fired in alternating five (5) round groups (Table IV, Appendix (A))
25	Salts and DNP 238911	EX 24-9 Standard (Figure 1, Appendix (B)).
25	Salts and DNP 238911	EX 24-12 Projectile like EX 24-7 with four (4) cannelures machined into the rear band and straightening of the slope on the large rear band rib, BUORD Sketch 329480 (Figure 2, Appendix (B)).
25	Salts and DNP 238911	Mk 34-1 Projectile like EX 24-7 with four (4) cannelures machined into the rear band. BUORD Dwg. 982549, No Revision, Mk 34 Mod 1. (Figure 3, Appendix (B)).

Date: 5 August 1952 - Elevation: 15 degrees

Gun: Type G Mod 7 No. 26741

No. Rds.	Loading and Fuzing	Type Projectiles - fired in alternating five (5) round groups (Table V, Appendix (A))
25	Salts and DNP 238911	EX 24-9 Standard (Figure 1, Appendix (B)).
25	Salts and DNP 238911	Mk 34-1 Projectile like EX 24-7 with four (4) cannelures machined into the rear band. BUORD Dwg. 982549, No Revision, Mk 34 Mod 1. (Figure 3, Appendix (B)).
25	Salts and DNP 238911	EX 24-12 Projectile like EX 24-7 with four (4) cannelures machined into the rear band and straightening of the slope on the large rear band rib, BUORD Sketch 329480 (Figure 4, Appendix (B)).

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

9. RESULTS:

a. The following table indicates the mean corrected range dispersions (D/R) for five (5) round groups of each projectile type for the five (5) comparative ranging programs conducted in accordance with reference (a) modified by references (b), (c), (d), (e), and in accordance with reference (f). Detailed results were reported by references (i) to (m) inclusive, summaries of which are included as Appendix (A), Tables I through V respectively.

Program	Projectile Type (Type letter corresponding to type letters in Tables - Appendix (A))	Gun	Five (5) Round Groups	D/R (%)
1	EX 24-7 (Type A Table I)	Type G-11	4	1.81
	Mk 34-1 (Type B Table I)	24930	4	0.80
	EX 24-9 (Type C Table I)	"	4	0.42
2	Mk 34-1 (Type A Table II)	Type G-11	8	0.49
	British Assembled Primer Group #1 (Type B Table II)	24930	1	0.35
	British Assembled Primer Group #2 (Type C Table II)	"	1	0.34
3	EX 24-12 (Type A Table III)	Type G-11	8	0.96
	EX 24-12 (Type B Table III) (Short Nose Plug)	24930	1	1.18
4	EX 24-9 (Type A Table IV)	Type G-11	5	0.44
	EX 24-12 (Type B Table IV)	24930	5	0.81
	Mk 34-1 (Type C Table IV)	"	5	0.54
5	EX 24-9 (Type A Table V)	Type G-7	5	0.35
	Mk 34-1 (Type B Table V)	26741	5	0.57
	EX 24-12 (Type C Table V)	"	5	1.16

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

PART D

CONCLUSIONS

10. As a result of the tests conducted it is concluded that:

a. When fired from the 3"/70 Caliber Type G Mod 7 Gun:

(1) The EX 24-9 projectiles gave better range performance than either the EX 24-12 or Mk 34-1 projectiles.

(2) The Mk 34-1 projectiles gave decidedly better range performance than the EX 24-12 projectiles.

b. When fired from the 3"/70 Caliber Type G Mod 11 Gun:

(1) The EX 24-9 projectiles gave better range performance than either the EX 24-7, EX 24-12 or Mk 34-1 projectiles.

(2) The Mk 34-1 projectiles gave decidedly better range performance than either the EX 24-7 or EX 24-12 projectiles.

(3) The British complete rounds assembled with Primer Groups No. 1 and No. 2 and with projectiles of similar design to the EX 24-9 projectiles gave range performance comparable to the EX 24-9 projectiles.

c. The EX 24-7 projectiles gave much better range performance in the worn Type G-7 Gun No. 24579 than in the new Type G-11 Gun No. 24930.

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

The tests upon which this report is based were conducted by:

C. W. BEAVERS, Lieutenant, USN,
Main Battery Division,
Armament Department
D. C. CAIN, Head of Interior Ballistics Division,
Armament Department


This report was prepared by:

C. W. BEAVERS, Lieutenant, USN,
Main Battery Division,
Armament Department

This report was reviewed by:

W. F. VOSE, Lieutenant Commander, USN,
Main Battery Division Officer,
Armament Department
W. B. ROBERTSON, Lieutenant Commander, USN,
Terminal Ballistics Officer,
Terminal Ballistics Department
L. C. KLINGAMAN, Commander, USN,
Armament Officer,
Armament Department
C. C. BRAMBLE, Director of Research,
Ordnance Group

APPROVED: J. F. BYRNE
Captain, USN
Commander, Naval Proving Ground


E. A. RUCKNER
Captain, USN
Ordnance Officer
By direction

CONFIDENTIAL
SECURITY INFORMATION

CONFIDENTIAL

NPG REPORT NO. 1070

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Fiftieth Partial Report

on

Test and Development of 3"/70 A.A. Projectiles

Fifty-Fifth Partial Report

on

Test and Development of 3"/70 Caliber Gun Barrels

Final Report

on

Comparative Ranging Tests of 3"/70 A.A. Projectiles

Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and

Mk 34 Mod 1, in Guns Type G Mod 7 and 11

*"This document contains information affecting the National
Defense of the United States within the meaning of the
Espionage Laws, Title 18, U.S.C., Sec. 793 and 794.
Its transmission or the revelation of its contents in any
manner to an unauthorized person is prohibited by law."*

**Project Nos.: NPG-Re3b-210-1-52
NPG-Re5a-21-1-52**

Date:

Copy No.: 14

No. of Pages: 12

JAN 7 1953

CONFIDENTIAL
SECURITY INFORMATION

TABLE I

Summary of Results of Comparative Ranging of 3"/70 A.A. Projectiles Mk 34 Mod 1,
Compared with Standard Type EX 24 Mod 7, and EX 24 Mod 9 Projectiles, Reported in
Detail on NPG Ranging Data Sheet No. 137 of 12 March 1952

Elevation: 15 degrees

Propellant: 10.11 lbs. Powder Index HKPG-1

Projectile

Loading: Epsom Salts

Nose: DNP 238911

Gun Data: 3"/70 Caliber Type G Mod 11 Serial No. 24930

Rifling - 1 turn in 20 calibers, Uniform Twist

Rounds before test: 37 actual rounds

37.65 ESR

Δ Do at 37.65 ESR; 0"002

Projectile Type: A - Standard EX 24-7 (Figure 2, Appendix (B)).
B - Mk 34 Mod 1 (Figure 3, Appendix (B)).
(BUORD Dwg. No. 932549, No Revision, Mk 34 Mod 1).
C - Standard EX 24-9 (Figure 1, Appendix (B)).

Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Projectile Type	Muzzle Velocity (ft./sec.)	Uncorrected		Corrected		Uncorrected		Corrected	
					Range (yds.)	Drift (yds.)	Range (yds.)	D/R (%)	Range (yds.)	D/R (%)	Range (yds.)	D/R (%)
5	5	3-7	A	3406±12	13534±273	161±11	13719±218	2.02	13719±218	1.59	13719±218	1.59
5	5	8-12	B	3411±8	14046±35	142±15	14209±30	0.25	14209±30	0.21	14209±30	0.21
5	5	13-17	C	3380±14	14027±74	174±11	14328±26	0.53	14328±26	0.18	14328±26	0.18
5	5	18-22	A	3432±18	13542±351	189±50	13616±306	2.59	13616±306	2.25	13616±306	2.25
5	5	23-27	B	3433±12	14217±187	192±23	14287±163	1.32	14287±163	1.14	14287±163	1.14
5	5	28-32	C	3384±8	14096±98	217±29	14378±80	0.70	14378±80	0.56	14378±80	0.56
5	4	34-37	A	3437±6	13563±224	179±14	13614±208	1.65	13614±208	1.53	13614±208	1.53
5	5	38-42	B	3422±10	14241±131	179±28	14359±97	0.92	14359±97	0.68	14359±97	0.68
5	5	43-47	C	3406±9	14211±62	189±8	14398±45	0.44	14398±45	0.31	14398±45	0.31
5	5	48-52	A	3443±12	13889±193	162±11	13913±200	1.39	13913±200	1.44	13913±200	1.44
5	5	53-57	B	3447±26	14370±106	149±7	14376±85	0.74	14376±85	0.59	14376±85	0.59
5	5	58-62	C	3399±20	14113±59	170±10	14328±57	0.42	14328±57	0.40	14328±57	0.40

CONFIDENTIAL

Comparative Ranging Tests of 3"/70 A.A. Projectiles Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12, and Mk 34 Mod 1, in Guns Type G Mod 7 and 11

NPG REPORT NO. 1070

TABLE II

Summary of Results of Comparative Ranging of 3"/70 A.A. Projectiles Mk 34 Mod 1, Compared with British Assembled Rounds, Primer Group Nos. 1 and 2, Reported in Detail on NPG Ranging Data Sheet No. 138 of 7 April 1952

Elevation: 15 degrees
Propellant: 10.11 lbs. Index HKPG-1 for Mk 34 Mod 1
10.00 lbs. 2 oz. Index FNP-293 for British Rounds
Primer Group Nos. 1 and 2
Projectile
Loading: Epsom Salts for Mk 34 Mod 1
Nose: DNP 238911 for Mk 34 Mod 1

Gun Data: 3"/70 Caliber Type G Mod 11 Serial No. 24930
Rifling - 1 turn in 20 calibers, Uniform Twist
Rounds before test: 99 actual rounds
99.65 ESR
 Δ Do at 99.65 ESR; 0%003

Projectile Type: A - Mk 34 Mod 1 (Figure 3, Appendix (B))(BUORD DWG. 982549,

No Revision, Mk 34 Mod 1)

B - British Assembled Round - Primer Group No. 1.

C - British Assembled Round - Primer Group No. 2.

Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Projectile Type	Muzzle Velocity (ft./sec.)	Uncorrected Range (yds.)	Uncorrected Drift (yds.)	Corrected Range (yds.)	Uncorrected D/R (%)	Corrected D/R (%)
5	5	2-6	A	3435 \pm 19	14142 \pm 114	121 \pm 10	14547 \pm 58	0.61	0.40
5	5	7-11	A	3432 \pm 15	14071 \pm 184	123 \pm 9	14289 \pm 130	1.31	0.91
5	5	12-16	A	3427 \pm 7	14169 \pm 57	135 \pm 10	14107 \pm 48	0.40	0.33
5	5	17-21	A	3442 \pm 19	14146 \pm 60	130 \pm 19	14418 \pm 79	0.42	0.55
5	5	22-26	B	3404 \pm 5	13914 \pm 50	92 \pm 10	14253 \pm 50	0.36	0.35
5	5	27-31	C	3405 \pm 2	13899 \pm 42	93 \pm 10	14233 \pm 48	0.30	0.34
5	5	32-36	A	3442 \pm 9	14178 \pm 48	123 \pm 14	14349 \pm 17	0.34	0.12
5	5	37-41	A	3439 \pm 21	14098 \pm 146	129 \pm 18	14284 \pm 56	1.04	0.39
5	5	42-46	A	3446 \pm 10	14140 \pm 89	114 \pm 14	14296 \pm 83	0.63	0.58
5	5	47-51	A	3434 \pm 16	14124 \pm 61	107 \pm 11	14333 \pm 38	0.43	0.27

CONFIDENTIAL
SECURITY INFORMATION

APPENDIX A

TABLE III

Summary of Results of Comparative Ranging of 3"/70 A.A. Projectiles Type EX 24 Mod 12, Compared with Type EX 24 Mod 12 Having Short Nose Plugs, Reported in Detail on NPG Ranging Data Sheet No. 139 of 3 June 1952

Elevation: 15 degrees

Propellant: 10.11 lbs. Powder Index HKPC-1

Projectile

Loading: Epsom Salts

Nose: DNP 238911

Gun Data: 3"/70 Caliber Type G Mod 11 Serial No. 24930

Rifling - 1 turn in 20 calibers, Uniform Twist

Rounds before test: 160 actual rounds

160.65 ESR

△ Do at 157.65 ESR; 0.003

Projectile Type: A - EX 24-12 (BUORD Sketch 329480)(Figure 4, Appendix (B)).
B - EX 24-12 (BUORD Sketch 329480)(Figure 4, Appendix (B)) using Short Nose Plug #239269.

Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Projectile Type	Muzzle Velocity (ft./sec.)	Uncorrected		Uncorrected		Corrected		Corrected	
					Range (yds.)	Drift (yds.)	Range (yds.)	D/R (%)	Range (yds.)	D/R (%)	Range (yds.)	D/R (%)
5	5	2-6	A	3439±6	14315±93	104±15	14109±115	0.65	14109±115	0.65	0.82	0.82
5	5	7-11	A	3438±14	14090±179	91±7	13892±170	1.27	13892±170	1.27	1.22	1.22
5	5	12-16	A	3453±2	14374±61	79±8	14110±52	0.42	14110±52	0.42	0.37	0.37
5	5	17-21	A	3447±17	14168±137	70±9	13934±149	0.97	13934±149	0.97	1.07	1.07
5	5	22-26	B	3426±17	8431±46	103±14	8292±98	0.55	8292±98	0.55	1.18	1.18
5	5	27-31	A	3471±9	14443±119	66±14	14100±119	0.82	14100±119	0.82	0.84	0.84
5	5	32-36	A	3479±17	14513±74	69±13	14135±30	0.51	14135±30	0.51	0.21	0.21
5	5	37-41	A	3454±10	14361±143	71±11	14088±182	1.00	14088±182	1.00	1.29	1.29
5	5	42-46	A	3458±14	14266±124	45±15	13974±116	0.87	13974±116	0.87	0.83	0.83

NOTE: Projectile Type EX 24 Mod 12 (BUORD Sketch 329480) was formerly designated Mk 34-1 (Modified)
BUORD Design Study Re3b-18-March-52.

CONFIDENTIAL

Comparative Ranging Tests of 3"/70 A.A. Projectiles Types EX 24 Mod 7,
EX 24 Mod 9, EX 24 Mod 12, and Mk 34 Mod 1, in Guns Type G Mod 7 and 11

NPG REPORT NO. 1070

TABLE IV

Summary of Results of Comparative Ranging of 3"/70 A.A. Projectiles Type EX 24 Mod 9,
Compared to EX 24 Mod 12 and Mk 34 Mod 1 3"/70 A.A. Projectiles, Reported in Detail
on NPG Ranging Data Sheet No. 142 of 16 July 1952

Elevation: 15 degrees
Propellant: 10.11 lbs. Powder Index HKPC-1
Projectile
Loading: Epsom Salts
Nose: DNF 238911

Gun Data: 3"/70 Caliber Type G Mod 11 Serial No. 24930
Rifling - 1 turn in 20 calibers, Uniform Twist
Rounds before test: 206 actual rounds
206.65 ESR

△ Do at 0"003 ESR: 157.65

Projectile Type: A - Standard EX 24-9 (Figure 1, Appendix (B)).
B - EX 24-12 (BUORD Sketch 329480) (Figure 4, Appendix (B)).
C - Mk 34 Mod 1 (BUORD Dwg. 982549, No Revision, Mk 34 Mod 1)
(Figure 3, Appendix (B)).

Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Projectile Type	Muzzle Velocity (ft./sec.)	Pres- sure	Uncorrected Range (yds.)	Uncorrected Drift (yds.)	Corrected Range (yds.)	Uncorrected D/R (%)	Corrected D/R (%)
5	5	1-5	A	3419±8	21.4±.3	14475±57	82±10	14163±47	0.39	0.33
5	5	6-10	B	3449±5	21.5±.4	14580±62	55±8	14118±54	0.43	0.38
5	5	11-15	C	3488±23	22.3±.5	14789±107	56±11	14157±104	0.72	0.73
5	5	16-20	A	3441±12		14498±87	66±14	14076±82	0.60	0.58
5	5	21-25	B	3472±14		14526±185	50±9	13967±162	1.27	1.16
5	5	26-30	C	3482±20		14736±70	59±26	14129±64	0.48	0.45
5	5	31-35	A	3438±8		14491±20	81±7	14081±47	0.14	0.33
5	5	36-40	B	3478±28		14597±144	63±11	14007±143	0.99	1.02
5	5	41-45	C	3480±20		14702±136	55±20	14108±72	0.93	0.51
5	5	46-50	A	3422±12		14482±59	84±9	14148±57	0.41	0.40
5	5	51-55	B	3471±14		14666±32	52±10	14115±71	0.22	0.50
5	5	56-60	C	3475±11		14714±106	81±11	14141±66	0.72	0.47
5	5	61-65	A	3417±15	20.7±.5	14462±97	74±6	14152±58	0.67	0.41
5	5	66-70	B	3478±11	21.9±.8	14626±91	60±14	14034±96	0.62	0.68
5	5	71-75	C	3462±6	21.6±.3	14623±90	87±14	14106±81	0.62	0.57

NOTE: Projectile Type EX 24 Mod 12 (BUORD Sketch 329480) was formerly designated Mk 34-1 (Modified)
BUORD Design Study Re3b-18-March-52.

CONFIDENTIAL - SECURITY INFORMATION

APPENDIX A

CONFIDENTIAL

Comparative Ranging Tests of 3"/70 A.A. Projectiles Types EX 24 Mod 7;
EX 24 Mod 9, EX 24 Mod 12, and Mk 34 Mod 1, in Guns Type G Mod 7 and 11

NPG REPORT NO. 1070

TABLE V

Summary of Results of Comparative Ranging of 3"/70 A.A. Projectiles Type EX 24 Mod 9,
Compared to EX 24 Mod 12, and Mk 34 Mod 1, 3"/70 A.A. Projectiles, Reported in Detail
on NPG Ranging Data Sheet No. 143 of 5 August 1952

Elevation: 15 degrees

Propellant: 9.95 lbs. Powder Index HKPG-1

Projectile

Loading: Epsom Salts

Nose: DNP 238911

Gun Data: 3"/70 Caliber Type G Mod 7 Serial No. 26741
Rifling - 1 turn in 20 calibers, Uniform Twist
Rounds before test: 33 actual rounds
32.77 ESR
 Δ Do at 16.77 ESR; 0.0003

Projectile Type: A - Standard EX 24-9 (Figure 1, Appendix (B)).

B - Mk 34 Mod 1 (BUORD DWG. 982549, No Revision, Mk 34 Mod 1)
(Figure 3, Appendix (B)).

C - EX 24-12 (BUORD Sketch 329480)(Figure 4, Appendix (B)).

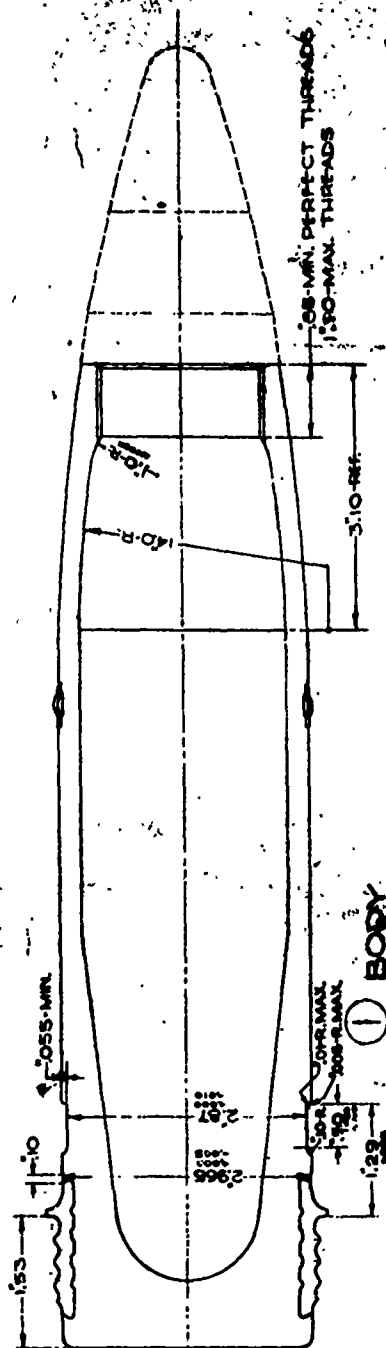
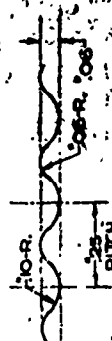
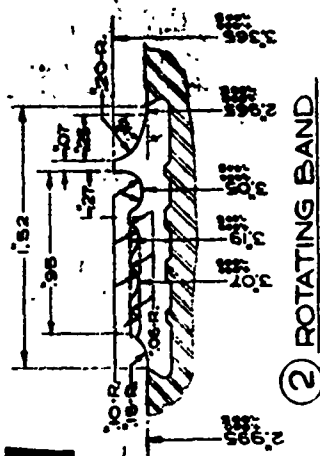
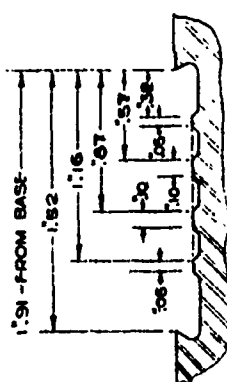
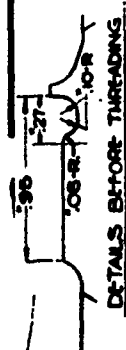
Rds. Fired	Rds. Ranged	Rd. Nos. in Program	Projectile Type	Muzzle Velocity (ft./sec.)	Pres- sure	Uncorrected Range (yds.)	Uncorrected Drift (yds.)	Corrected Range (yds.)	Uncorrected D/R (%)	Corrected D/R (%)
5	5	2-6	A	3358±16	20.2±.7	14245±74	8±14	14160±13	0.52	0.09
5	5	7-11	B	3411±21	21.6±.6	14488±111	23±11	14175±119	0.77	0.84
5	4	12-16	C	3416±7	21.6±.2	13998±70	21±20	13658±96	0.50	0.70
5	5	17-21	A	3362±13		14352±61	18±10	14250±16	0.43	0.11
5	5	22-26	B	3409±17		14420±94	52±7	14112±56	0.65	0.40
5	5	27-31	C	3413±9		14071±114	22±12	13751±141	0.81	1.03
5	5	32-36	A	3369±19		14314±66	26±20	14184±63	0.46	0.44
5	5	37-41	B	3413±9		14562±57	46±13	14241±37	0.39	0.26
5	5	42-46	C	3404±9		14073±163	22±18	13786±197	1.16	1.43
5	5	47-51	A	3355±16		14275±77	44±10	14214±45	0.54	0.32
5	5	52-56	B	3414±6		14482±78	49±4	14155±93	0.54	0.66
5	5	57-61	C	3421±21		13968±110	8±10	13612±181	0.79	1.33
5	5	62-66	A	3377±8	20.0±.4	14360±58	35±12	14196±48	0.40	0.34
5	5	67-71	B	3409±8	20.3±.5	14500±66	34±2	14193±48	0.46	0.34
5	5	72-76	C	3418±9	20.8±.6	14230±105	-11±15	13891±110	0.74	0.79

NOTE: Projectile Type EX 24 Mod 12 (BUORD Sketch 329480) was formerly designated Mk 34-1 (Modified)
BUORD Design Study Re3b-18-March-52.

CONFIDENTIAL - SECURITY INFORMATION

APPENDIX A

Figure 1



NOTE: SPECIFICATIONS, NOTES, DIMENSIONS AND PARTS NOT SHOWN ARE SAME AS 370-PROJECTILE (A.A.) TYPE FX-24 MOD. 8 SK. 23872. MARKING ON PROJECTILE SHALL BE CHANGED TO SHOW FX-24 MOD. 8 SK. 328486.

CONFIDENTIAL

[illegible]

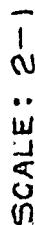
உயிர்ப்பிழை

CONFIDENTIAL

249578

[illegible]

10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24
 25
 26
 27
 28
 29
 30
 31
 32
 33
 34
 35
 36
 37
 38
 39
 40
 41
 42
 43
 44
 45
 46
 47
 48
 49
 50
 51
 52
 53
 54
 55
 56
 57
 58
 59
 60
 61
 62
 63
 64
 65
 66
 67
 68
 69
 70
 71
 72
 73
 74
 75
 76
 77
 78
 79
 80
 81
 82
 83
 84
 85
 86
 87
 88
 89
 90
 91
 92
 93
 94
 95
 96
 97
 98
 99
 100
 101
 102
 103
 104
 105
 106
 107
 108
 109
 110
 111
 112
 113
 114
 115
 116
 117
 118
 119
 120
 121
 122
 123
 124
 125
 126
 127
 128
 129
 130
 131
 132
 133
 134
 135
 136
 137
 138
 139
 140
 141
 142
 143
 144
 145
 146
 147
 148
 149
 150
 151
 152
 153
 154
 155
 156
 157
 158
 159
 160
 161
 162
 163
 164
 165
 166
 167
 168
 169
 170
 171
 172
 173
 174
 175
 176
 177
 178
 179
 180
 181
 182
 183
 184
 185
 186
 187
 188
 189
 190
 191
 192
 193
 194
 195
 196
 197
 198
 199
 200
 201
 202
 203
 204
 205
 206
 207
 208
 209
 210
 211
 212
 213
 214
 215
 216
 217
 218
 219
 220
 221
 222
 223
 224
 225
 226
 227
 228
 229
 230
 231
 232
 233
 234
 235
 236
 237
 238
 239
 240
 241
 242
 243
 244
 245
 246
 247
 248
 249
 250
 251
 252
 253
 254
 255
 256
 257
 258
 259
 260
 261
 262
 263
 264
 265
 266
 267
 268
 269
 270
 271
 272
 273
 274
 275
 276
 277
 278
 279
 280
 281
 282
 283
 284
 285
 286
 287
 288
 289
 290
 291
 292
 293
 294
 295
 296
 297
 298
 299
 300
 301
 302
 303
 304
 305
 306
 307
 308
 309
 310
 311
 312
 313
 314
 315
 316
 317
 318
 319
 320
 321
 322
 323
 324
 325
 326
 327
 328
 329
 330
 331
 332
 333
 334
 335
 336
 337
 338
 339
 340
 341
 342
 343
 344
 345
 346
 347
 348
 349
 350
 351
 352
 353
 354
 355
 356
 357
 358
 359
 360
 361
 362
 363
 364
 365
 366
 367
 368
 369
 370
 371
 372
 373
 374
 375
 376
 377
 378
 379
 380
 381
 382
 383
 384
 385
 386
 387
 388
 389
 390
 391
 392
 393
 394
 395
 396
 397
 398
 399
 400
 401
 402
 403
 404
 405
 406
 407
 408
 409
 410
 411
 412
 413
 414
 415
 416
 417
 418
 419
 420
 421
 422
 423
 424
 425
 426
 427
 428
 429
 430
 431
 432
 433
 434
 435
 436
 437
 438
 439
 440
 441
 442
 443
 444
 445
 446
 447
 448
 449
 450
 451
 452
 453
 454
 455
 456
 457
 458
 459
 460
 461
 462
 463
 464
 465
 466
 467
 468
 469
 470
 471
 472
 473
 474
 475
 476
 477
 478
 479
 480
 481
 482
 483
 484
 485
 486
 487
 488
 489
 490
 491
 492
 493
 494
 495
 496
 497
 498
 499
 500
 501
 502
 503
 504
 505
 506
 507
 508
 509
 510
 511
 512
 513
 514
 515
 516
 517
 518
 519
 520
 521
 522
 523
 524
 525
 526
 527
 528
 529
 530
 531
 532



REF.: BUORD DWG. NO. 982349 NO. REV.
3/70 PROJECT (A.A) MK. 34 MOD. I

DWG. NO.:
APL-37

Current:

CONFIDENTIAL

NPG REPORT NO. 1070

Comparative Ranging Tests of 3"/70 A.A. Projectiles
Types EX 24 Mod 7, EX 24 Mod 9, EX 24 Mod 12 and
Mk 34 Mod 1, in Guns Type G Mod 7 and 11

DISTRIBUTION

Bureau of Ordnance:

Ad3	1
Re3	1
Re3b	2
Re5	1
Re5a	2

Chief of Ordnance, Dept. of the Army Attn: ORDTX-AR	2
---	---

Commanding General Aberdeen Proving Ground Aberdeen, Maryland Attn: Technical Information Section, Development and Proof Services	1
---	---

Naval Gun Factory	1
-------------------	---

Navy Research Section Library of Congress Washington 25, D. C. (Via BUORD Re3)	2
---	---

Local:

OMB-A2	1
OT	1
OTL	1
File	1

CONFIDENTIAL
SECURITY INFORMATION

APPENDIX C